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Kent et al.

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(54) **DIGITAL RACK INTERFACE POD (DRIP) WITH INTELLIGENT POWER CONTROL SYSTEM AND METHOD**

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(51) **Int. Cl.**
G06F 1/26 (2006.01)
G06F 1/30 (2006.01)

(52) **U.S. Cl.**
CPC ***G06F 1/266*** (2013.01); ***G06F 1/30*** (2013.01); ***G06F 1/263*** (2013.01)

(58) **Field of Classification Search**
CPC G06F 1/263; G06F 1/266; G06F 1/30
See application file for complete search history.

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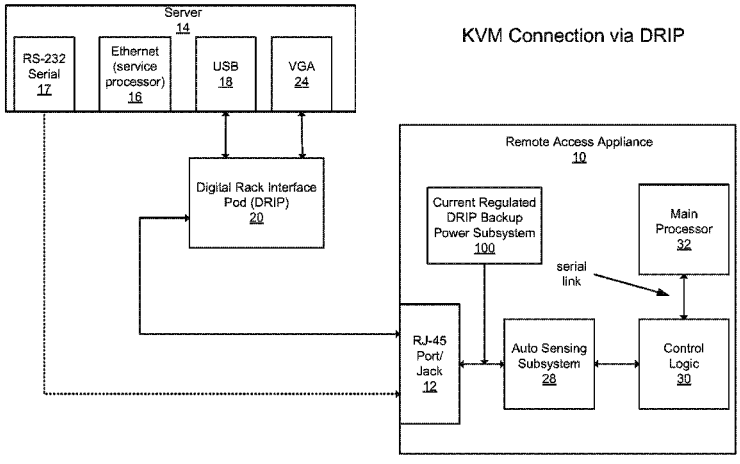
(74) *Attorney, Agent, or Firm* — Harness, Dickey & Pierce, P.L.C.

(57) **ABSTRACT**

An intelligent power control system and method adapted for use with a digital rack interface pod (DRIP). A switching regulator generates a set output voltage. If power is available from a USB port of an external device, such as an external server, then the system uses this power to power the DRIP. If DC power is detected as being received on a different input from an external power transformer, then the system may still continue to use the power being received from the USB port to power the DRIP. If power from the USB port of the external device is lost but power from the external transformer is present, then the system may use the power available from the external transformer to power the DRIP. If the DRIP is being powered by USB power from the external device, and no DC power is available from the external transformer, but backup power from an appliance to which the DRIP is coupled is being received on one of the DRIP's power input ports, then the DRIP may switch to backup power from the appliance if power from the USB port of the external device (e.g., server) is lost. The system thus intelligently prioritizes the use of power available from a plurality of different power sources to maintain the DRIP powered on when one or more of the power sources is lost or otherwise not available.

22 Claims, 7 Drawing Sheets



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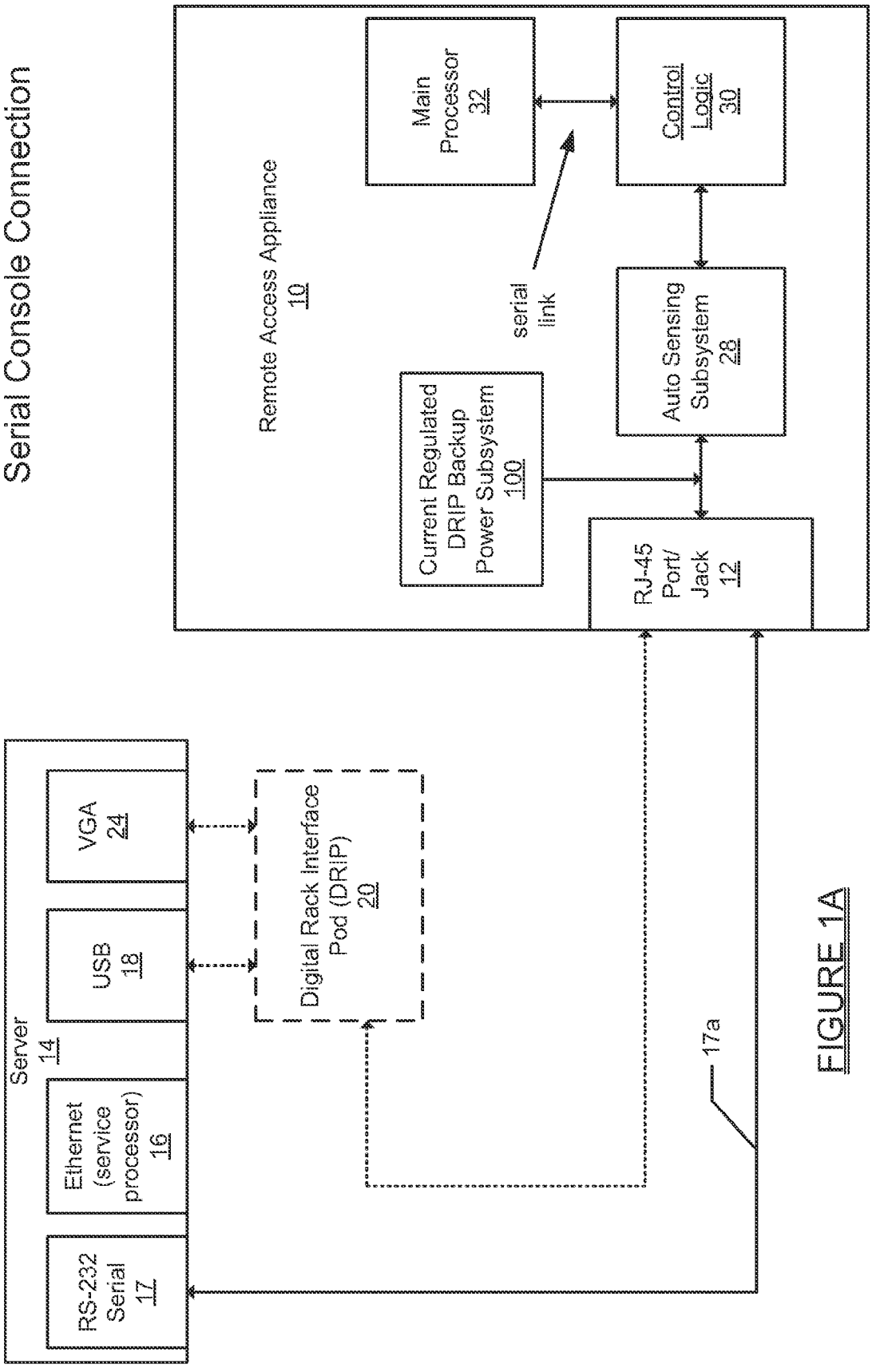
Serial Console Connection
Remote Access Appliance
10
Main Processor
32
Control Logic
30
serial link
Auto Sensing Subsystem
28
Current Regulated DRIP Backup Power Subsystem
100
RJ-45 Port/ Jack
12
Server
14
RS-232 Serial
17
Ethernet (service processor)
16
USB
18
VGA
24
Digital Rack Interface Pod (DRIP)
20
17a

FIGURE 1A

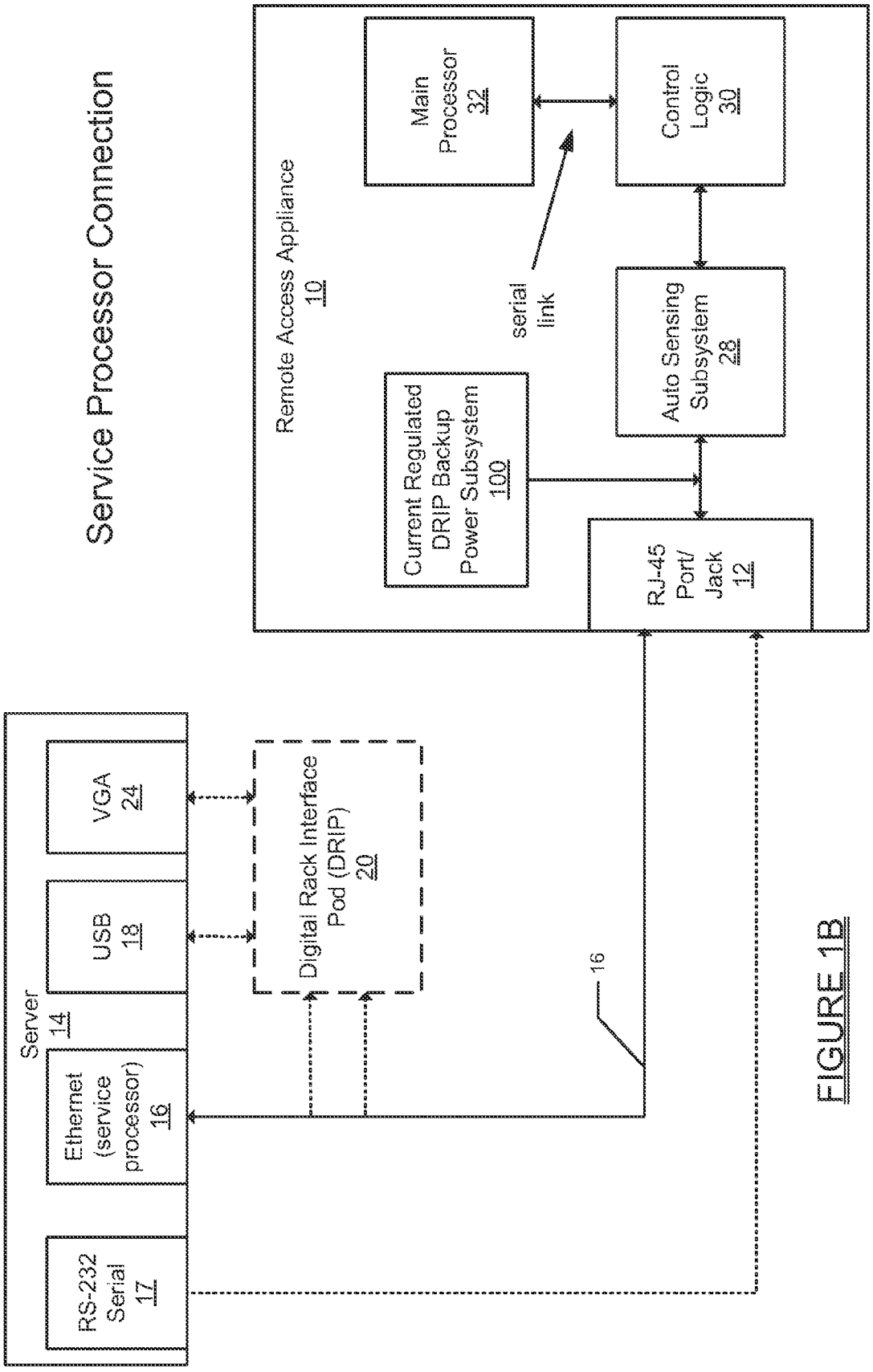
Service Processor Connection
Remote Access Appliance
10
Main Processor
32
Control Logic
30
serial link
Auto Sensing Subsystem
28
Current Regulated DRIP Backup Power Subsystem
100
RJ-45 Port/ Jack
12
Server
14
VGA
24
USB
18
Digital Rack Interface Pod (DRIP)
20
Ethernet (service processor)
16
RS-232 Serial
17
16

FIGURE 1B

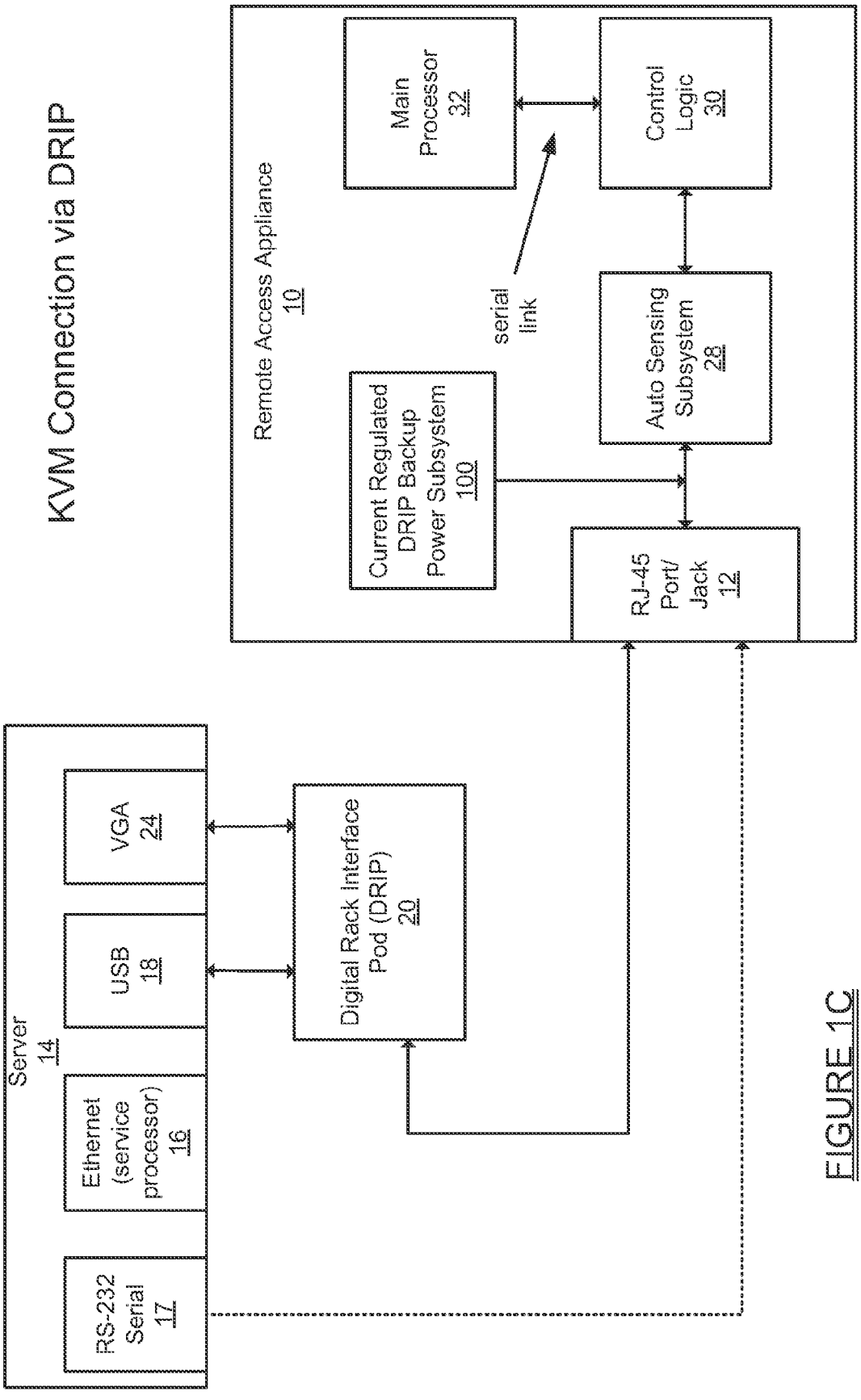
KVM Connection via DRIP
Remote Access Appliance
10
Main Processor
32
Control Logic
30
serial link
Current Regulated DRIP Backup Power Subsystem
100
Auto Sensing Subsystem
28
RJ-45 Port/ Jack
12
Server
14
VGA
24
USB
18
Ethernet (service processor)
16
RS-232 Serial
17
Digital Rack Interface Pod (DRIP)
20

FIGURE 1C

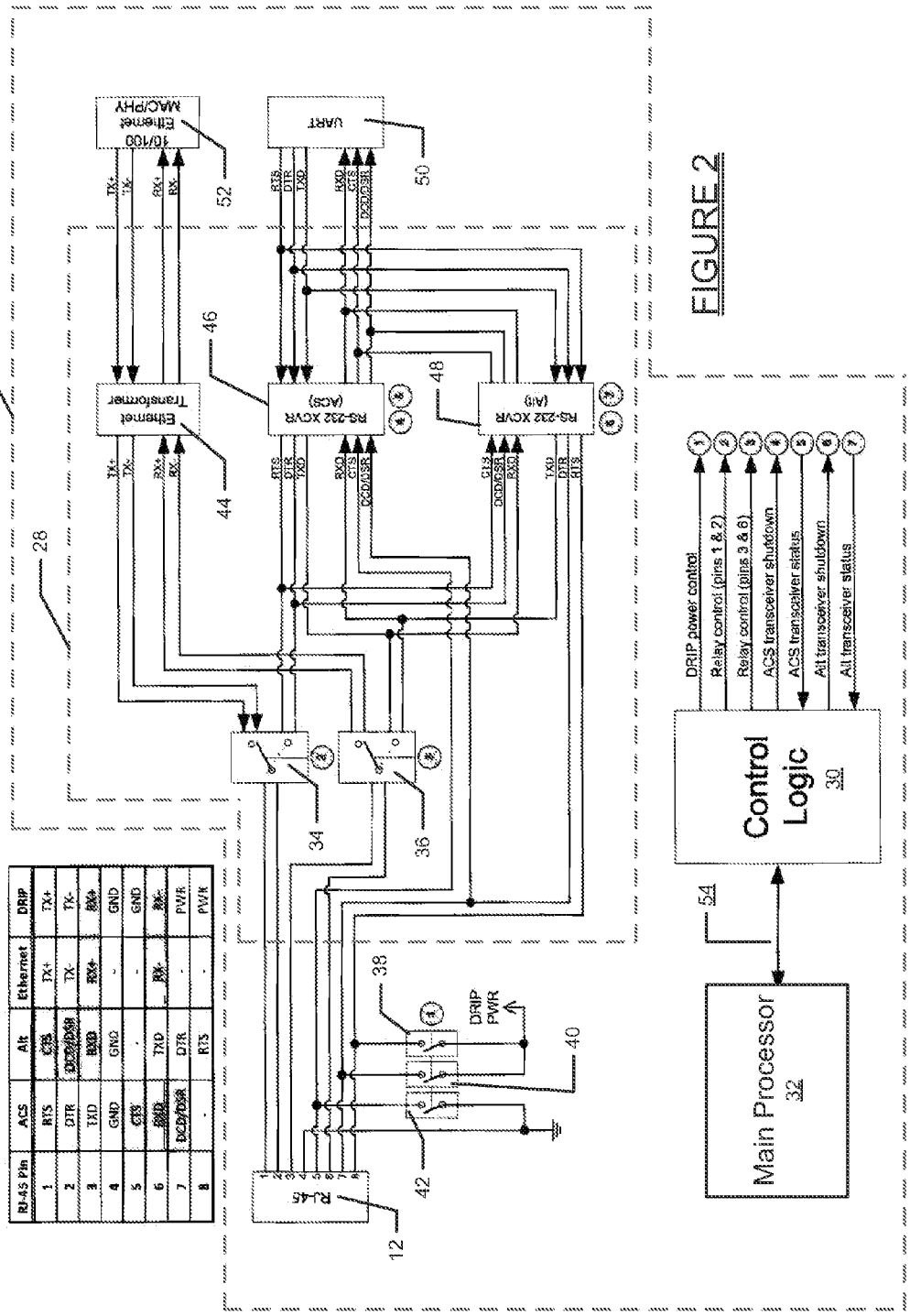

FIGURE 2

FIGURE 3

RJ-45 Pin	ACS	Alt	Ethernet	DRIP
1	RTS	CTS	TX+	TX+
2	DTR	DCD/DSR	TX-	TX-
3	TXD	RXD	RX+	RX+
4	GND	GND	-	GND
5	CTS	-	-	GND
6	RXD	TXD	RX-	RX-
7	DCD/DSR	DTR	-	PWR
8	-	RTS	-	PWR

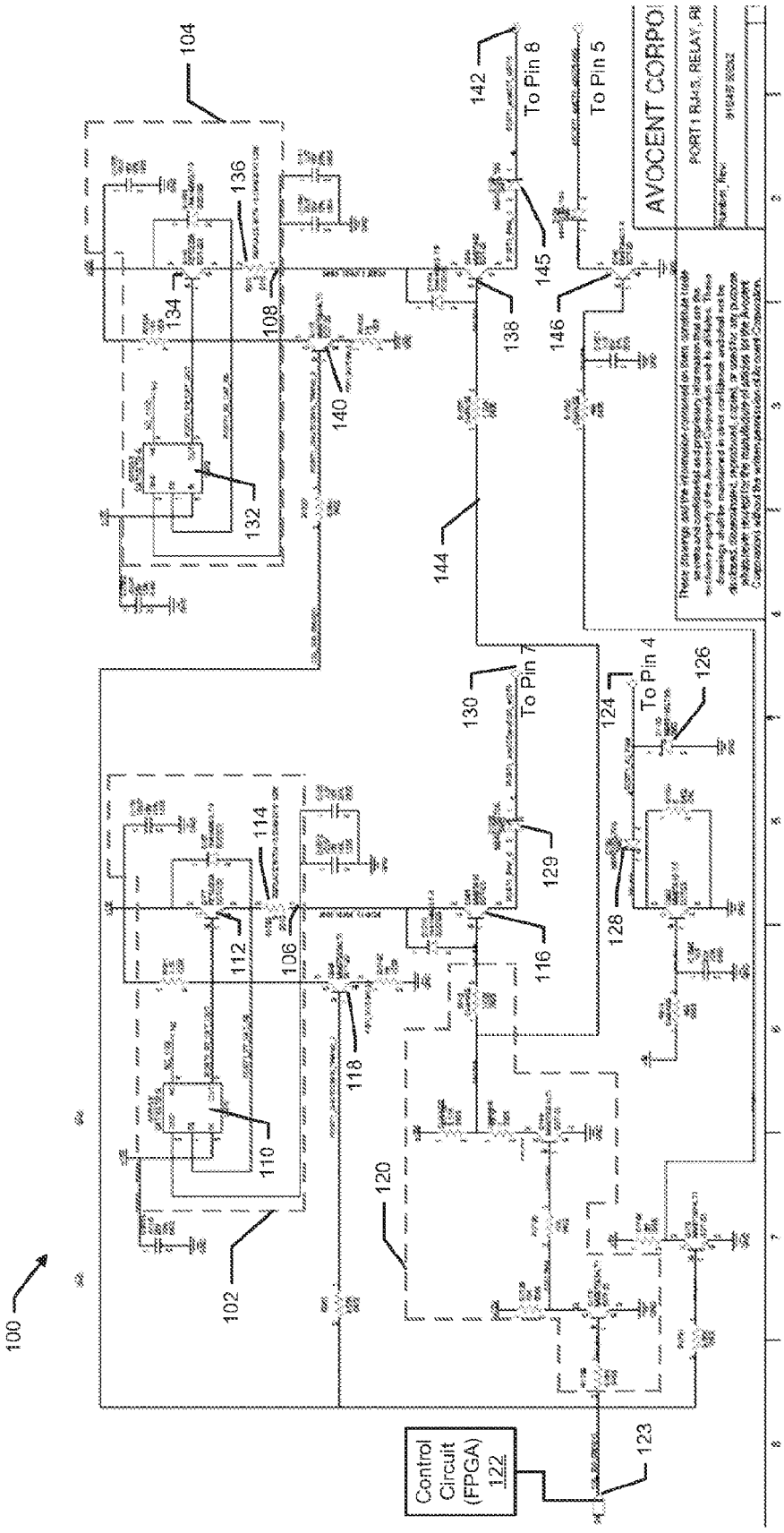
100
102
104
106
108
110
112
114
116
118
120
123
124
126
128
129
130
132
134
136
138
140
142
144
145
146
To Pin 8
To Pin 5
To Pin 7
To Pin 4
Control Circuit (FPGA) 122
AVOCENT CORPO

FIGURE 4

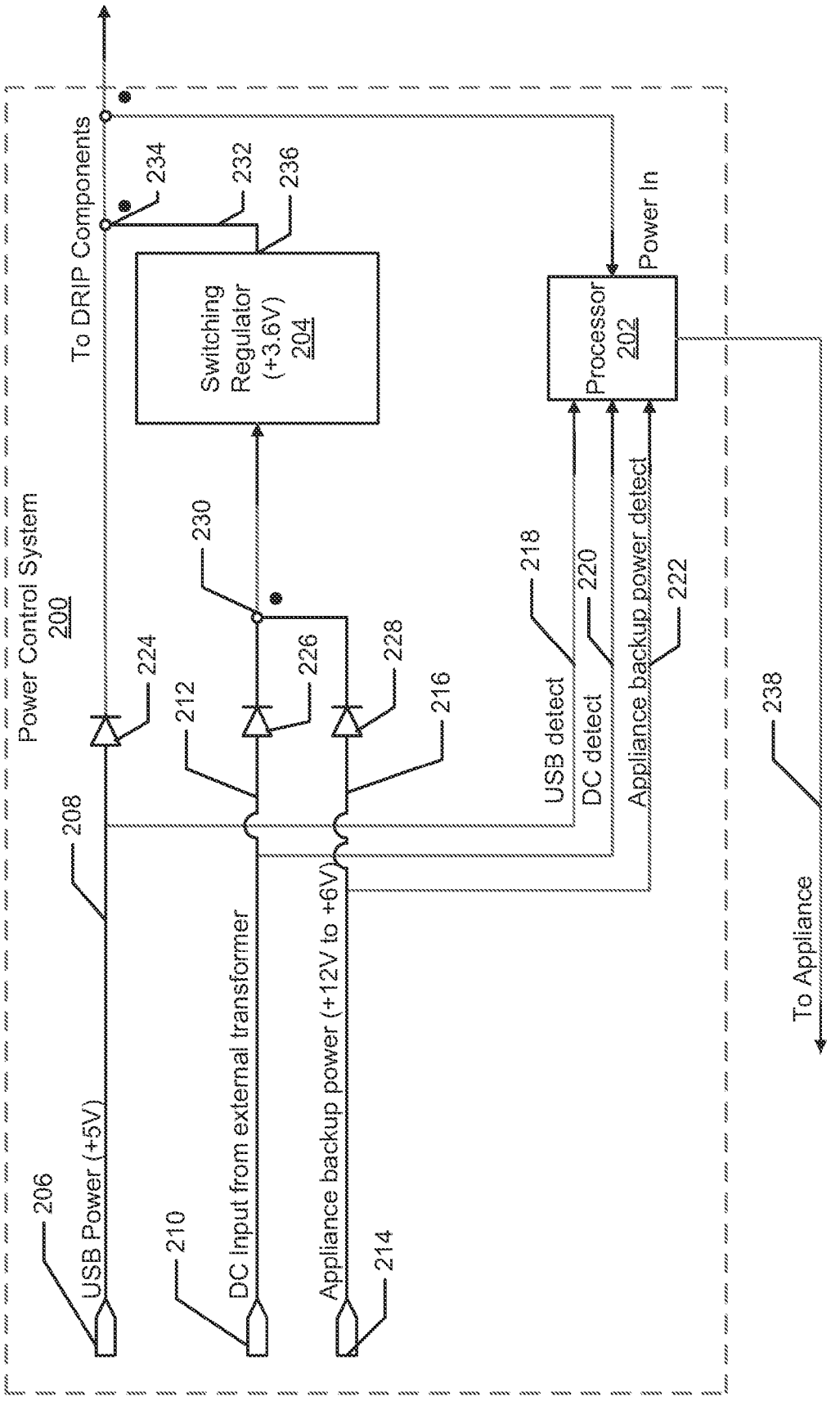
Power Control System
200
To DRIP Components
234
232
236
Switching Regulator (+3.6V)
204
Processor
202
Power In
230
218
220
222
224
226
228
212
216
208
USB detect
DC detect
Appliance backup power detect
238
206
USB Power (+5V)
210
DC Input from external transformer
214
Appliance backup power (+12V to +6V)
To Appliance

FIGURE 5

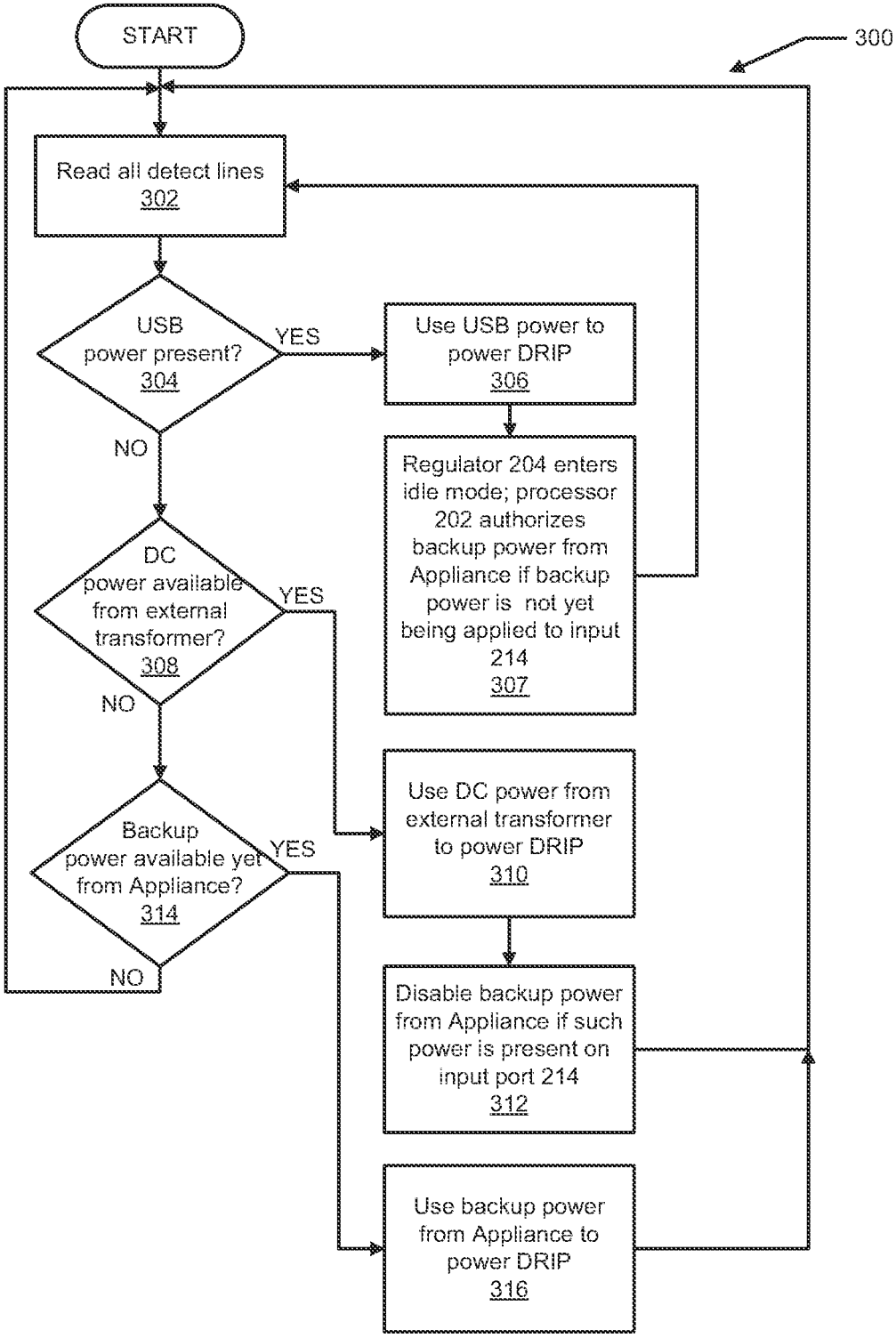
START
300
Read all detect lines
302
USB
power present?
304
YES
Use USB power to
power DRIP
306
NO
Regulator 204 enters
idle mode; processor
202 authorizes
backup power from
Appliance if backup
power is not yet
being applied to input
214
307
DC
power available
from external
transformer?
308
YES
NO
Use DC power from
external transformer
to power DRIP
310
Backup
power available yet
from Appliance?
314
YES
NO
Disable backup power
from Appliance if such
power is present on
input port 214
312
Use backup power
from Appliance to
power DRIP
316

FIGURE 6

DIGITAL RACK INTERFACE POD (DRIP) WITH INTELLIGENT POWER CONTROL SYSTEM AND METHOD

CROSS-REFERENCE TO RELATED APPLICATIONS

This application claims the benefit of U.S. Provisional Application No. 61/389,616 filed on Oct. 4, 2010 and U.S. Provisional Application No. 61/488,665 filed on May 20, 2011. The disclosures of the above applications are incorporated herein by reference.

FIELD

The present disclosure relates to rack interface pods that are used to interface a server to a remote access appliance, and more particularly to a digital rack interface pod (DRIP) that includes an intelligent power control subsystem that intelligently prioritizes the use of power from a plurality of different power sources when one or more of the power sources becomes unavailable for use.

BACKGROUND

The statements in this section merely provide background information related to the present disclosure and may not constitute prior art.

Remote access appliances are used frequently in modern day data centers to interface with and establish communications links with a plurality of servers or other serial or Ethernet type devices. Traditionally this has required separate remote access appliances, one for Ethernet and one for serial. In one implementation, the assignee of the present application, Avocent Corp., may also use the Ethernet interface on the remote access appliance to receive digitized data from a digital rack interface pod (DRIP), where the DRIP is interfaced between the server and the remote access appliance. The DRIP receives analog video signals and serial data from the server and converts this information to a digital format, and then forwards the digital information in Ethernet protocol format to the appliance.

A first method by which the DRIP may be powered is through a step down transformer that is plugged into an AC outlet in the data center. To enable this, the DRIP incorporates a power input port to receive the rectified DC voltage from the step down transformer. Obviously, the drawback with this requirement is the need for an external step down transformer and the need for an available AC power outlet to plug the step down transformer into. As one will appreciate, this configuration can also lead to a significant increase in the amount of wiring present in a data center room. Typically a separate DRIP is used to interface a single output port of a remote access appliance to a single server. So if 40 servers are being used in the data center, then 40 DRIPs will be required. If 500 servers are being used, then 500 DRIPs will be required, and so forth. As one can see, the requirement of an available power outlet and the use of a separate power transformer for each DRIP can potentially lead to significant additional costs in implementing a DRIP.

A second means by which a DRIP may be powered is from its server's universal serial bus (USB) port. This approach is typically preferred by many data center managers as it eliminates the use of step down transformers and the need for available AC power outlets to plug the step down transformers into, and thus also makes for a "cleaner" installation with less wiring in the vicinity of the servers. However, if the server shuts down for any reason, then the DRIP will lose its power. This will end any Ethernet session that the DRIP was handling. If the server is then powered back up a short time later, many server models will delay applying power to the designated power pins of its USB port for at least several seconds while it begins to re-boot. So if the DRIP has been relying on power from the server's USB port, this means that the DRIP will have lost power when the server shuts down, and further that power will typically not be applied to the DRIP when the server begins to re-boot. At some point during the boot-up process the server will again begin applying power to the appropriate pins of its USB port, which will then power up the DRIP again, allowing a remote user to establish a new session with the DRIP and the server.

In the event the server has gone down because of a problem, and a data center person needs to troubleshoot the server, the reliance on power from the server's USB port is particularly disadvantageous to the DRIP. This is because when the server begins to re-boot, the BIOS screen, which typically is generated during the first few seconds of the boot-up process, will not be captured by the DRIP because the DRIP will not yet be powered back on. As those skilled in the art will appreciate, the ability to capture the BIOS screen on a server when it re-boots is a significant advantage when it comes to remotely attempting to troubleshoot a problem with a server. Without being able to capture the BIOS screen information, the ability to perform remote access troubleshooting on the server is significantly compromised.

Still further, if the DRIP is not able to draw on power from a step down transformer, but some other power source was able to supply power to the DRIP besides the USB port of the server, then a challenge arises as to how to control which power source the DRIP is to use, and under what condition(s). If the DRIP could intelligently switch to a backup power source (i.e., other than power from a step down transformer) when its primary power source (i.e., power from the USB port of the server) is lost, this would allow the DRIP to remain powered on when the server it is communicating with shuts down. This would also allow the Ethernet session that was in progress with the DRIP to be maintained. This would be extremely valuable because it would allow the DRIP to remain powered on while the server is powered back on and begins to re-boot. In this circumstance the DRIP would be able to capture the BIOS screen information output from the server's USB port.

BRIEF DESCRIPTION OF THE DRAWINGS

The drawings described herein are for illustration purposes only and are not intended to limit the scope of the present disclosure in any way.

FIGS. **1**A-**1**C are high level block diagrams illustrating several different types of connections that may be made between a communications port of a remote access appliance and a remote server;

FIG. **2** is an electrical schematic diagram of an autosensing subsystem of the remote access appliance that detects whether an Ethernet or serial protocol device has been connected to a communications port on the remote access appliance via a communications cable, and also which is able to detect which one of two predetermined pinouts for the plug of the cable is being used when the cable is transmitting information to and from the remote access appliance using a serial protocol;

FIG. **3** is a table showing the pinout configuration of the RJ-45 jack on the remote access appliance when a serial connection is established with a serial device using an ACS

pinout, when a serial connection is established with a serial device using an alternative ("Alt") serial pinout, when a connection is established with an Ethernet device, and when a digital rack interface pod ("DRIP") is coupled to the RJ-45 jack;

FIG. **4** is an electrical schematic diagram illustrating a power backup subsystem of the appliance that is able to automatically apply power to a DRIP if the DRIP loses its power from the serial port of a server while a session is in progress;

FIG. **5** is a diagram of one embodiment of an intelligent power control system that the DRIP may incorporate to intelligently prioritize the use of a plurality of different power sources; and

FIG. **6** is a flowchart of one exemplary sequence of operations that may be performed by the power control system shown in FIG. **5**.

DETAILED DESCRIPTION

The following description is merely exemplary in nature and is not intended to limit the present disclosure, application, or uses. It should be understood that throughout the drawings, corresponding reference numerals indicate like or corresponding parts and features.

Referring to FIGS. **1**A-**1**C, there is shown a remote access appliance **10** in accordance with one embodiment of the present disclosure. For convenience the remote access appliance **10** will be referred to throughout the following discussion simply as "appliance **10**". The appliance **10** has a port shown as a RJ-45 port (i.e., jack) **12**, which may be connected to a server **14** in at least three different ways. However, it will be appreciated that while the following discussion references a connection to a server, that the appliance **10** may be connected to many other types of devices. For example, many of the RS232 serial Avocent made appliance's connections are to other equipment than a server. Very common are connections to "smart" power strips made by Avocent Corp. and other manufacturers, and routers are very commonly connected to (either directly in an RJ-45 RS232 console or configuration port, or by way of a RJ to DB9 adapter). And, the appliance **10** would also typically support a serial console application at the remote user to operate with any other serial device. But again, for the following discussion, a connection between the appliance **10** and the server **14** will be used for explanation purposes.

FIG. **1**A illustrates a first way in which a cable **17***a*, which is typically a Cat5 cable, is used to connect the RJ-45 port **12** of the appliance **10** to an RS-232 port of the server **14**. This connection could also be made by using a RJ-45 to DB-9 adapter on the RJ45 cable end of the CAT5 cable from the appliance **10** to the server **14**, such that the server doesn't have to have an RJ-45 interfaced serial port.

FIG. **1**B illustrates a second way in which a cable **16***b*, typically a Cat5 cable, is used to connect the RJ-45 port **12** to an Ethernet port **16** of the server **14**. Typically this type of connection enables the server's Service Processor (SP) to communicate various types of relevant information on the performance of the server (e.g., processor utilization, temperature, etc.) to the appliance **10** using the Ethernet communications protocol. In this configuration there is only the Cat5 cable between the port of the appliance **10** and the Ethernet port **16** that is associated with the service processor of the server **14**. It should also be understood that the "Ethernet (service processor) **16**" interface is only Ethernet by way of protocol, and is not the server's **14** main Ethernet interface. That is, this interface is only for the purpose of a subsystem (i.e., the Service Processor) on the server **14** that monitors the "health," performance, total utilization (CPU bandwidth, RAM, etc.), temperatures, etc. relating to the server **14**.

FIG. **1**C shows a third type of connection that involves the use of a digital rack interface pod ("DRIP") **20**. The DRIP **20** may be coupled via a cable **20***a* to the RJ-45 port **12** of the appliance **10**. The DRIP **20** may also be coupled via a suitable cable **26** to a universal serial bus (USB) port **18** of the server **14**, and via a suitable cable **22** to a VGA port **24**. The USB port **18** enables keyboard and mouse related information to be transmitted to and from the server **14** in serial form. The DRIP **20** is available from Avocent Corp. of Huntsville, Ala. The DRIP **20** operates to digitize video signals from the VGA port **24** of the server **14** and to place same in Ethernet form for transmission to the appliance **10**. The DRIP **20** also functions to convert serial format signals from the USB port **18** to Ethernet format. The appliance **10** also may include an autosensing subsystem **28**, a control logic subsystem **30** a main processor **32**, and a current regulated DRIP backup power supply **100**, to be discussed in the following paragraphs in connection with FIG. **4**.

As will be appreciated then, the appliance **10** may need to communicate using either Ethernet protocol signals or serial protocol signals via its RJ-45 port **12**, depending on what type of device is communicating with the appliance. The appliance **10** provides the significant advantage of being able to automatically sense whether Ethernet protocol signals or serial protocol signals are being received at its RJ-45 port without any intervention from a data center individual. This is accomplished by the auto sensing subsystem **28** and the control logic subsystem **30** working in combination with the main processor **32**. The autosensing subsystem **28** effectively monitors the signals received on the RJ-45 port **12** and, in connection with the control logic subsystem **30** and the main processor **32**, automatically internally configures various electronic components so that communications can be appropriately routed and handled within the appliance **10**.

One significant benefit of the above-described autosensing feature is a potential reduction in the number of ports that need to be included on the appliance **10**. Another significant advantage of an "autosensing" port as described herein, is that the appliance **10** is able to determine what to configure to without being told whether the other device is serial, KVM alone (i.e., no service processor subbed out), service processor alone, or a combination of KVM and service processor. The advantage of having a switchable port (whether done by port autosensing or by manual configuration) is that with x number of ports on an appliance (e.g., 40), a user can add the next thing to connect to and so long as its one of the things supported (i.e., service processor alone, serial, KVM, or KVM and service processor), the user has a port available for the next device to be coupled to. Thus, the port autosensing feature can potentially enable a reduction of ports needed to support all things while expanding the connections on the appliance **10**.

Referring now to FIG. **2**, a schematic diagram of a portion of the appliance **10** is shown that illustrates in greater detail the autosensing subsystem **28** and the control logic subsystem **30**. The autosensing subsystem **28** is denoted by a dashed line. A first semiconductor relay **34** is coupled to pins **1** and **2** of the jack that forms the RJ-45 port **12**. A second semiconductor relay **36** is coupled to pins **3** and **6** of the same jack. A plurality of transistor switch paths **38** and **40** may be incorporated for coupling DC power to the DRIP **20** and transistor switch path **42** may be provided for providing an additional ground path for the DRIP (additional to that of the always-present ground path on RJ-45 port **12** pin **4**). The first semiconductor relay **34**

is coupled to an Ethernet transformer **44** and a first RS-232 transceiver **46**. The first RS-232 transceiver **46** in this example is adapted to be used when a serial connection is made at the RJ-45 jack **12** with the mating RJ-45 plug having an ACS pinout configuration. The ACS pinout configuration is a pinout configuration recognized in the industry and used by Avocent Corp. on the serial ports of various forms of data center equipment available from Avocent Corp. A second RS-232 transceiver **48** is incorporated and designated with the notation "Alt", which is used for serial devices that require a different, predetermined pinout configuration. The specific Alt pinout configuration given in the Table of FIG. **3** is used for various serial devices made by Cisco Corp. and others. It will be appreciated that other pairs of pinouts may potentially be incorporated, and the present disclosure is not limited to use with any two specific pinout configurations.

As will be explained in greater detail in the following paragraphs, it is also a significant benefit that the autosensing subsystem **28** is able to automatically detect whether the ACS pinout or the Alt pinout is being used with the RJ-45 plug (and thus with the external serial device) that is connected to the RJ-45 port **12**. This feature will also be described in greater detail in the following paragraphs. The ACS and Alt pinouts are shown in the table of FIG. **3** along with a pinout for an Ethernet connection and a pinout used by an Avocent Corp. manufactured DRIP **20**.

Referring further to FIG. **2**, both of the RS-232 transceivers **46** and **48** are coupled to a universal asynchronous receiver/transmitter (UART) **50**, and the Ethernet transformer **44** is coupled to a 10/100 Ethernet/MAC/PHY interface subsystem **52**. Numbers 1 through 8 at various ones of the above-mentioned components indicate where control signals from the control logic subsystem **30** may be applied as well as which components may transmit signals to the control logic subsystem **30**. An important feature of the RS-232 transceivers **46** and **48** is their ability to sense when a valid RS-232 input voltage is present at any of their pins. For this purpose, one specific model of RS-232 transceiver that is especially well suited for the present application is a 3Driver/5 Receiver SP 3243E "intelligent" RS-232 transceiver available from several vendors as drop in replacements for one another. The vendors and models include Maxim MAX3243, Texas Instruments MAX3243, Sipex SP3243, Intersil ICL3243, and Exar SP3243E. This specific model of RS-232 transceiver, that will be referred to as the "model 3243" type of transceiver, has a "Status" output (pin **21** on the SP3243E RS-232 transceiver) that indicates whether a valid RS-232 voltage is present at any of its input pins. This detection feature was principally intended for low power applications where it is desired to power down the RS-232 transceiver when no serial cable is plugged into the serial port that is in communication with the RS-232 transceiver. The operation of the present appliance **10**, however, takes advantage of the fact that normal 10/100 Ethernet voltages fall outside (i.e., below) the range of valid RS-232 signal levels. Accordingly, the "Status" output pin of the SP3243E RS-232 transceiver will not falsely detect Ethernet signals as valid RS-232 signals, as the voltages associated with the Ethernet signals will be below those of valid RS-232 signals. This feature allows use of the RJ-45 port **12** to bidirectionally communicate Ethernet signals to and from the appliance **10** without the two RS-232 transceivers **46** and **48** recognizing the presence of the Ethernet signals and falsely interpreting the Ethernet signals as RS-232 signals.

Referring further to FIG. **2**, the two semiconductor relays **34** and **36** are shown in their default positions (i.e., in Ethernet "mode"). Power to the DRIP **20** is disabled as a result of transistor switch paths **38-42** being in the positions shown in FIG. **2**. Pins **1**, **2**, **3** and **6** from the jack that forms the RJ45 port **12** are connected to the Ethernet transformer **44**. Both of the RS-232 transceivers **46** and **48** will be shut down. No signals will be present on pins **5**, **7** and **8**, and pin **4** is tied to ground. If the DRIP **20** is the component which is coupled to the RJ-45 port **12**, then the DRIP **20** will receive power from the USB port of the device, which in one example could be the USB port **18** of server **14** as shown in FIG. **1**. The main processor **32** will virtually immediately recognize that an Ethernet device (i.e., the DRIP **20**) has been connected to the RJ-45 port **12** as it starts communicating with the DRIP **20**. In a very short time period (typically within several seconds) the main processor **32** will recognize that the Ethernet device is the DRIP **20**, and will then provide a control signal to the control logic subsystem **30** that closes transistor switch paths **38** and **40**, as well as transistor switch path **42**. This causes DC power (typically +10.8 volts) to be applied to pins **7** and **8** of the RJ-45 port **12** to be used by the DRIP **20** if needed, and supplies an added ground return path (in addition to that of the hard-strapped RJ-45 pin **4** ground return path) on pin **5** of the RJ-45 port **12**. If the session with the DRIP **20** ends for any reason (e.g., the DRIP **20** is unplugged from the RJ-45 port **12**), then the main processor **32** will automatically and virtually immediately signal the control logic subsystem **30** to turn off power to the DRIP **32** by deactivating transistor switch paths **38**, **40**, and **42**. This interrupts the application of DC power to pins **7** and **8** of the RJ-45 port **12** and interrupts the ground path to pin **5**. Those pins **7**, **8**, and **5** of RJ-45 port **12** will then see an open circuit of high impedance, with regard to the DRIP powering circuitry of the appliance **10**.

If the DRIP **20** is physically connected to the jack that forms the RJ-45 port **20** but there is no Ethernet activity detected to be occurring on the RJ-45 port **12** (from the DRIP **20** or from any other Ethernet device), the main processor **32** will send an "autosense" command to the control logic subsystem **30**. This causes the control logic subsystem **30** to turn off DRIP **20** power by deactivating transistor switch paths **38**, **40**, and **42**, as well as to power down both RS-232 transceivers **46** and **48**. The first semiconductor relay **34** will be left as shown in FIG. **2** connecting pins **1** and **2** of the RJ-45 port **12** to the Ethernet transformer **44**. However, the control logic subsystem **30** will cause the second semiconductor relay **36** to be switched to a "serial mode". This couples pin **3** of the RJ-45 port **12** to the TXD pin of RS-232 transceiver **46** and to the RXD pin of RS-232 transceiver **48**. It also couples pin **6** to the RXD pin of the RS-232 transceiver **46** and to the TXD pin of the RS-232 transceiver **48**. The main processor **32** will then check the status signals from the RS-232 transceivers **46** and **48** to look for the presence of valid RS-232 voltage level signals on the RXD or TXD pins of either RS-232 transceiver **46** or **48**.

If the main processor **32** detects the presence of a valid RS-232 voltage level signal on the RS-232 transceiver **46**, which means a valid RS-232 level signal on pin **6** of the RJ-45 port **12** is present, this indicates that a connection has just occurred with a serial device having an ACS pinout. The main processor **32** then enables (powers up) the RS-232 (ACS) transceiver **46** and generates a control signal to the control logic subsystem **30** to switch the semiconductor relay **34** to serial mode, as indicated in phantom in FIG. **2**. This connects pins **1** and **2** of the RJ-45 port **12** with the RTS and DTR pins of the RS-232 (ACS) transceiver **46**. Serial communications will then be fully enabled using the RS-232 (ACS) transceiver **46**.

If the status signal from the RS-232 (Alt) transceiver **48** indicates that a valid RS-232 level voltage signal has been received on its RXD input via pin **3** of the RJ-45 port **12**, then

the main processor **32** powers up the RS-232 (Alt) transceiver **48** and generates a control signal to the control logic subsystem **30** that is used to switch the semiconductor relay **34** to the serial mode, which is shown in phantom in FIG. **2**. In the serial mode pins **1** and **2** of the RJ-45 port **12** are connected with the CTS and DCD/DSR pins of the RS-232 (Alt) transceiver **48**. Pins **3** and **6** of the jack forming the RJ-45 port **12** will be connected through the semiconductor relay **36** with the RXD pin and TXD pin, respectively, of the RS-232 (Alt) transceiver **48**. Serial communications will then be fully enabled using the RS-232 (Alt) transceiver **48**.

If both RS-232 transceivers **46** and **48** generate status signal outputs to the main processor **32** that indicates that valid RS-232 level voltage signals are being received on their inputs, then it is understood that an invalid serial pinout is being used on the RJ-45 plug that has been coupled to the RJ-45 port **12**. In this instance both RS-232 transceivers **46** and **48** will be left powered down by the main processor **32**.

If one or the other of the RS-232 transceivers **46** or **48** is operating but then the RS-232 level signals are lost, such as if the RJ-45 plug is removed from the RJ-45 port **12**, then the main processor **32** sends a control signal to the control logic subsystem **30** that causes it to switch the semiconductor relay **36** back to the Ethernet mode (shown in solid lines in FIG. **2**). The main processor **32** then waits for a short amount of time, for example 5 seconds, and then shuts down both of the RS-232 transceivers **46** and **48**. Thereafter, the semiconductor relay **36** will be switched back to the serial mode (shown in phantom in FIG. **2**) and the autosensing of the status outputs of both RS-232 transceivers **46** and **48** will continue until either an Ethernet signal is detected or a valid RS-232 voltage signal is detected, as described above.

It is important to note that the appliance **10** is able to distinguish between ACS and Alt serial pinouts because there are no RJ-45 pins that are inputs in both the ACS and Alt pin-out configurations. So only one of the two RS-232 transceivers **46** or **48** will detect valid RS-232 signal input levels when one or the other of the ACS or Alt pinouts is used.

If an Ethernet device is connected to the RJ-45 port **12**, it will not be detected as a serial device, and the above described operational sequence will reach the implementation of the 5 second delay time. This delay time allows the Ethernet MAC/PHY **52** time to establish a link. When the main processor **32** sees an Ethernet link, it will tell the control logic subsystem **30** to stop autosensing and stay in Ethernet mode. At any point during the above described operations, the main processor **32** may query the control logic subsystem **30** to determine the state of the RJ-45 port **12** or to force it into a particular mode.

The autosensing feature of the appliance **10** thus provides a significant and highly advantageous means for monitoring and immediately detecting the presence of an Ethernet device or a serial device that has been connected to its RJ-45 port. An even further advantage is that the appliance **10** of the present disclosure is able to automatically sense the specific pinout (i.e., either an ACS or Alt pinout) of a serial device that has been connected to its RJ-45 port, and to accommodate the sensed pinout without the need for the data center individual to set any configuration switches on the appliance **10** or to otherwise take any other action. The ability to transmit both Ethernet and serial protocol signals over a single port can also allow the use of a single 1-U height appliance to be used in a rack and have the ability to flexibly build a connection system using only Cat5 cables (no dongle devices, RIPs or DRIPs) to any combination of Ethernet-interfaced service processor ports or RS232 ports of Alt or ACS pinouts. The serial ports can be used with other DB-connector-interfaced serial ports with RJ-45 to DB adapters. And, where KVM is needed, DRIPs may be used on any of the ports (as all support Ethernet) of the appliance **10**, and can be installed initially or added in later in the case of using what was a service processor port.

Referring now to FIG. **4**, a backup power subsystem **100** of appliance **10** is shown. The backup power subsystem **100** is provided for generating a backup power source to the DRIP **20**, and thus for the purpose of the following discussion it will be assumed that the connection scheme shown in FIG. **1**C is being implemented. In other words, the DRIP **20** is interfacing the appliance **10** to the USB port **18** and the VGA port **24** of the server **14**.

In the connection scheme of FIG. **1**C, power will be drawn from the USB port **18** of the server **14** to power the DRIP **20** during normal operation. In the event the server **14** shuts down and the power from the USB port **18** is lost, the backup power subsystem **100** will provide sufficient power to maintain the DRIP **20** powered up, and thus maintain the existing session with the DRIP **20**. To accomplish this the backup power subsystem **100** may incorporate a first shunt current regulator subsystem **102** (hereinafter simply "regulator subsystem **102**") that generates an output at point **106** that is connected to pin **7** of the RJ-45 port **12** (i.e., the jack that forms the port), and a second shunt current regulator subsystem **104** (hereinafter "regulator subsystem **104**") that generates an output at point **108** that is connected though transistor switch paths to pin **8** of the RJ-45 port **12**. Pin **4** of the RJ-45 port **12** is tied to the appliance **10** digital ground through rectifier diodes for a return current path from the DRIP **20**. Pin **5** of the RJ-45 port **12** is tied to the appliance **10** digital ground through a transistor switch path for a return current path from DRIP **20**. In this example the construction of the two regulator subsystems **102** and **104** is identical, but they need not be identical.

The regulator subsystem **102** includes a precision shunt current regulator **110** (hereinafter "current regulator **110**"), a first (pass through) transistor **112**, and a current sensing resistor **114**. The regulator subsystem **102** supplies current to a second (switching) transistor **116**. A third (shutdown) transistor **118** (shown as an NPN transistor) is used to override normal regulation operation of the first transistor **112** for turning off the regulator's output of current entirely, which will be described in greater detail in the following paragraphs.

A biasing network **120**, responsive to a signal from a control circuit **122**, operates the switch transistor paths, turning on or off the voltage to the DRIP **20** from the appliance **10** at the RJ-45 port **12** by either allowing or shutting off the flow of current through the two send paths going to pins **7** and **8** of the RJ-45 port **12**, as well as allowing or shutting off the flow of current through the one return path from pin **5** of the RJ-45 port **12**. Pin **4** of the RJ-45 port **12** always allows a current return path, as it is used both as a ground in the RS232 operation of RJ-45 port **12** and the currently described DRIP **20** powering operation. In one implementation the control circuit **122** may comprise a field programmable gate array (FPGA). The signal from the control circuit **122** applied to circuit point **123** also controls on and off operation of the second transistor **116**. In one specific form, a 3.3 v TTL/IO pin of the FPGA may be used that controls the control input to circuit point **123**. Pin **4** of the RJ-45 port **12** is tied to circuit point **124**, which in turn is tied to ground through a pair of Schottky diodes **126** and **128**. Another Schottky diode **129** is at output **130**, which is tied to pin **7** of the RJ-45 port **12**. This prevents current from flowing back into the output **130**.

The regulator subsystem **104** is essentially identical to regulator subsystem **102** in construction and includes a precision shunt current regulator **132** (hereinafter "current regulator **132**"), a first (pass through) transistor **134**, and a current

sensing resistor **136**. The regulator subsystem **104** provides current to a second (switching) transistor **138**. A third (shutdown) transistor **140** (shown as an NPN transistor), responsive to signals from the control circuit **122** applied to its base, can override normal regulation of the first transistor **134** for turning off the regulator's output of current entirely. The second transistor **138** forms a switch to control the output current flowing to output **142**, which is coupled to pin **8** of the RJ-45 port **12**. The biasing of second transistor **138** is also controlled by the biasing network **120** via circuit line **144**. A Schottky diode **145** is placed in series with the output **142** to prevent current from flowing into the output.

It will be appreciated that the operation occurring at regulator subsystem **104** and output **142** will be identical to that described above for regulator subsystem **102** and output **130**. The current regulator **110** of the regulator subsystem **102**, in one implementation, may comprise a CAT 102TDI-G precision regulator available from ON Semiconductor, Inc. of Phoenix, Ariz. The CAT 102TDI-G precision current regulator includes a built in comparator and generates a precision 0.6 v internal precision reference voltage that its internal comparator uses to control its output on pin **3** thereof.

Initially it will also be understood that since the backup power subsystem **100** is intended to only supply "backup" power to the DRIP **20**, several conditions preferably exist before any power is applied by the backup power subsystem **100** to the outputs **130** and **142**. During normal operation when the DRIP **20** is in use it will be drawing power from the USB port **18** of the server **14**. This also lessens somewhat the burden on the power supply (not shown) of the appliance **10** during normal operation when the DRIP **20** is being used. A first required condition may be that before power is applied to outputs **130** and **142**, that there be an Ethernet sync indication present in the Ethernet MAC/PHY of an Ethernet device. This sync indication is available to the CPU of the appliance **10** through query of that Ethernet device. Unless and until such an Ethernet sync signal is present, the backup power subsystem **100** will preferably not apply power to the outputs **130** and **142**, and would not switch in a ground return path on the RJ-45's pin **5** (through transistor **146**). A second condition that preferably is present before the backup power subsystem **100** begins applying power to the DRIP **20** is that there has been a confirmation by the appliance **10** that the DRIP **20** is actually the component that is coupled to the RJ-45 port **12** of the appliance **10**. That confirmation may be in the form of receipt of embedded code from a processor or other component within the DRIP **20** that is received and recognized by the main processor **32** of the appliance **10**. Such code will confirm to the appliance **10** that it is in fact the DRIP **20** that is actually coupled to its RJ-45 port **12** and not some other type of Ethernet device. Lastly, the third condition that preferably exists is that there be a KVM remote session in progress involving a remote user using the appliance **10** and DRIP **20** to access the server attached to DRIP **20**. This could happen with a user at the appliance **10** using a local access, but would most commonly occur with a remote user over an Ethernet and/or internet connection using remote access software that accompanies the appliance **10**. Preferably the remote user will be logged in to the appliance **10** and will be using the DRIP **20** to communicate information between the KVM/USB interface of the DRIP **20** and the server **14**. Preferably only when these three conditions are all present will the backup power subsystem **100** of the appliance **10** begin applying power to pins **7** and **8** and switch in the ground return path on pin **5** of the RJ-45 port **12** on the appliance **10**.

The voltage that will be output to pins **7** and **8** of the RJ-45 port **12** should preferably be sufficiently large to overcome the line losses that may be expected to occur over the length of the cable (in this example over the "Send" and "Return" wires of a Cat5 cable) that is being used to couple the DRIP **20** to the RJ-45 port **12** of the appliance **10**. The length of such a cable may extend up to an industry standard of 330 feet (about 100.5 meters). It is preferred that the output voltage at pins **7** and **8** of the RJ-45 port **12**, relative to ground, will preferably be somewhat less than +12 volts, and in this example that voltage will preferably be about +10.8 volts. This is achieved by the four voltage drops across the first transistor **112**, the current sensing resistor **114**, the second transistor **116**, and the diode **129** as they relate to output **130**, and also by the four voltage drops across components **134**, **136**, **138** and **145**. The +10.8 volt output produced is anticipated to be ample to compensate for anticipated line losses in the Cat5 cable, even when the cable extends up to 330 feet in length, while still being below a the clamp voltage determined by a set of protection device's (ESD/clamp diodes) that are referenced to a +12 volt chassis voltage being supplied by a supply (not shown) of the appliance **10**. The clamp voltage is highly desired to protect the previously mentioned model 3243 RS232 transceivers, for both electrostatic discharge (ESD) and for some RS232 levels that could legally be transmitted into the RJ-45 port **12** from serial devices that could be connected to the RJ-45 port **12** (but, while adhering to the upper voltage of the RS232 spec, the RS232 voltages could be of a great enough magnitude to potentially damage the model 3243 RS232 transceivers). Dropping the output of the voltage used to back power the DRIP **20** from the appliance **10** below the positive direction clamp voltage achieved with clamp diodes and a +12 v potential to clamp to prevents a constant clamping of the DRIP **20** back-powering voltage put out on the RJ-45 Port **12**, pins **7** and **8**. This +10.8 volt backup supply voltage also leaves sufficient "headroom" in the backup supply voltage at the DRIP **20** so that the backup supply voltage can be regulated down to a lesser, suitable supply voltage by an internal voltage regulator circuit within the DRIP **20**.

Turning now to operation of the backup power subsystem **100**, it will be assumed that the three conditions described above are in place and that the backup power subsystem **100** is generating a backup power signal to pins **7** and **8** of the RJ-45 port **12** (i.e., at outputs **130** and **142**). The first transistors **112** and **134** will each be in saturation, the second transistors **116** and **138** will both be turned on as a result of the signal being applied by control circuit **122** to point **123**. The third (i.e., shutdown) transistors **118** and **140** will both be non-conducting at this point. Transistor **146** will also be in a conducting state as well via a signal from the control circuit **122** applied at circuit point **123**, thus coupling pin **5** of the RJ-45 port **12** to ground. Pin **4** of the RJ-45 port **12** will be tied to ground via the Schottky diodes **126** and **128** that are connected to circuit point **124**. Pin **4** is tied to ground whether the appliance **10** is operating strictly with a serial connection to some external serial device or operating with the DRIP **20**. In effect, pin **4** is rectified to ground for serial operation by the use of the two Schottky diodes **126**, **128** configured as shown. Pin **4** of the RJ-45 port **12** and the transistor switched in path of pin **5** of the RJ-45 Port **12** form return paths for current being used to power the DRIP **20** when the DRIP **20** is actually drawing power from the backup power subsystem **100**. Schottky diodes **126** and **128** form a full wave rectifier for RS232 currents on RJ-45 port **12** pin **4**, such that return currents can be either positive or negative in direction of flow. This satisfies the direction of flow needed on pin **4**, and path, for both RS232 currents and DRIP **20** power return currents. This configuration is always in place for RJ-45 port **12** pin **4**, regardless of what the operation of RJ-45 Port **12** is. That

operation includes RJ-45 port **12** being in a service processor Ethernet mode of operation, a KVM mode of operation (with back power on or not), or if that RJ-45 Port **12** is in a serial mode of operation. RJ-45 port **12** pin **5**'s return path need only deal with the one direction of current flow that it satisfies with the one diode between pin **5** and transistor **146**, and the transistor **146**, as that pin **5** is only ground for the one mode of KVM and DRIP back powering.

When the DRIP **20** loses its primary power from the USB port **18**, it will then start drawing current from pins **7** and **8** of the RJ-45 port **12** (i.e., from outputs **130** and **142**). The backup power subsystem **100** provides the advantage that it allows a slight "surge" of current beyond the designed for 100 ma output from each of pins **7** and **8**. This is due to the regulators **102** and **104** being shunt regulators that provide constant current past their set point of shunting (100 mA in this case), and any additional loading that would desire greater current will cause a drop in the output voltage of the regulators (and ultimately the outputs of **130** and **142** to RJ-45 port **12** pins **7** and **8**, respectively). As the DRIP **20** starts drawing current, the current regulators **110** and **132**, the first transistors **112**, **134** and the current sense resistors **114**, **136** allow the current being drawn by the DRIP **20** to rise momentarily above a predetermined maximum current set by the value of the sense resistors **114**, **136** and each regulator circuit's +0.6 v precision reference voltage that these reference voltages are being compared to by the internal comparators. The current being drawn then settles down at some value below the predetermined maximum current in a normal operating DRIP **20** powering scenario. In this example the sense resistors are each shown as 6 ohm resistors, which provides an output current at each of pins **7** and **8** of the RJ-45 port **12** of up to 100 ma (i.e., on each "Send" wire of the Cat5 cable). If an output current of 200 ma is desired at each of pins **7** and **8**, then the sense resistors **114**, **136** may be changed to 3 ohms. A current of 100 ma per each Send wire of the Cat 5 cable provides the DRIP **20** with up to about 1 watt of power that it may draw, with max cable length (with max drops of line loss in each direction), before the shunt operation of the current regulators **110**, **132** begins to shunt voltage while maintaining the max current being drawn. However, it is anticipated that most DRIPs designed to work with this system will require 1 watt or less for operation in low-power mode (while being back-powered). So, even at the max specified operational length of 330 ft of Cat5 cable between the appliance **10** and DRIP **20**, 1 watt will be sufficient to maintain the DRIP **20** powered on in low power mode after the USB power is lost. To provide 1 watt at the load of the DRIP **20**, the maximum power available from the current regulators **110**, **132** to the DRIP **20** is selected such that the DRIP **20** is only able to implement a desired "low power mode" of operation where only some limited functionality is provided for the DRIP **20**. The regulators are able to be changed to allow for greater values of current allowed to the DRIP **20** by a change in the sense resistor values at **114** and **146**, were there to be a desire for that later. So while the limited functionality of the DRIP **20**, while it is being back powered from the appliance **10**, may give up some performance capabilities (e.g., KVM video sampling), the DRIP **20** nevertheless stays powered up. The DRIP **20** is able to turn on the KVM video sampling so quickly that, when the USB power from the server **14** does comes back on, the video of the BIOS screen will be caught.

When the current being drawn by the DRIP **20** rises to a maximum level greater than what was agreed upon (and what the resistor **114** and **146** settings allow for without shunt regulation occurring), in this example enough greater than the shunt setting of 200 ma total from the two current regulators **110**, **132** that the shunting begins occurring, then the internal transistor in each current regulator will start to pull out of saturation. It will pull out of saturation gradually, if the load applied by the DRIP **20** increases gradually, or it will do so abruptly if the load applied by the DRIP **20** increases abruptly. As the load increases past the 100 ma limit per regulator, the voltage at the emitter of each first (i.e., pass) transistor **112**, **134** will begin to drop. The drop will be gradual if the increase in load is gradual and abrupt if the increase in load is abrupt. The more load that the current regulator **110**, **132** sees, all the way up to a short circuit condition, the more that the emitter voltage will drop on the first transistors **112**, **134**, until the emitter voltage of each first transistor **112**, **134** goes to virtually zero. And at that lowest output voltage from transistor **112**, **134**, there will still be the maximum shunt current being supplied to the DRIP **20**. That is, in this short circuit condition, if there is only 1 v or less output **112**, **113**, and so out of pins **7** and **8** of RJ-45 port **12**, there is still the 100 mA per each of pins **7** and **8** being supplied to the shorted condition on those pins. However, the result of this approach is that any usable power will be essentially turned off to 7 and 8 of the RJ-45 port **12** if a short circuit condition occurs in the DRIP **20**. The DRIP **20** cannot use the small amount of voltage present at the RJ-45 port **12**, or at DRIP **20** end of the Cat5 cable (which would be even less in potential), to create its voltage rails for operation, regardless of the current available at the DRIP **20**, when the regulators have fully shunted their voltage outputs in appliance **10**. If the short circuit condition goes away gradually, power to the DRIP **20** will be returned gradually (and eventually can become usable power to the DRIP **20**), and if the condition releases from being shorted abruptly, the power available to the DRIP **20** will be returned to totally usable power just as abruptly.

Now consider the situations where the DRIP **20** is connected to the RJ-45 port **12** and operating normally (i.e., being powered by the USB port **18** of the server **14**), or whether the DRIP **20** is being powered by power from the backup power subsystem **100**. In either situation, if the DRIP **20** is then unplugged from the RJ-45 port **12**, this condition will be sensed virtually immediately by the main processor **32** (FIG. **1**) by the loss of the Ethernet session with the DRIP **20** (from seeing a loss of sync in the MAC/PHY that is used in the appliance **10** for RJ-45 port **12**'s Ethernet operation). The main processor **32** communicates this condition to the control circuit **122**. The control circuit **122** applies a signal to circuit point **123** so that current flow to pins **7** and **8** of the RJ-45 port **12** is interrupted virtually immediately. This is accomplished by the signal applied to circuit point **123** turning off switch transistors **116**, **138**, **146**, thru the biasing network of **120**. Also, the regulator's "turn-off" transistors **118** and **140** are driven to saturation (i.e., turned on), which pull out of saturation completely the current regulator's pass transistors **112** and **134**. The minimum of those transistors just mentioned required to change state to turn off of DRIP powering would be switch transistors **116**, **138**, and **146**. The added shut down of the regulators is included as an added precaution with no appreciable added cost. The action of turning off the transistors **116** and **138** quickly interrupts current flowing to circuit points **130** and **142**, and thus virtually immediately removes power from pins **7** and **8** of the RJ-45 port **12**. As such, there is no reasonable possibility of an individual inadvertently damaging some external device by unplugging the DRIP **20** from the Cat5 cable and then plugging the Cat5 cable in to a different component, or unplugging the Cat5 cable from the appliance's **10** RJ-45 port **12** and plugging in a cable connected to some other device.

Finally, and as mentioned above, no power will be applied to pins **7** and **8** of the RJ-45 port **12** until the three above-explained, predetermined conditions are present (i.e., DRIP **20** plugged in to RJ-45 port **12** with and its identity recognized by the main processor **32** and a session in progress). During this state the two shutdown NPN transistors **118** and **140**, will be turned on, which turns off completely the pass transistors **112** and **134**. And switch transistors **116**, **138**, and **146** are all turned off. Only when the three predetermined operating conditions with the DRIP **20** are satisfied will (1) the shutdown transistors **118** and **140** be turned off and (2) the switch transistors **116**, **138**, and **146** be turned on, thus allowing voltages to be developed at outputs **130** and **142**.

From the above it will be appreciated that the backup power subsystem **100** forms a highly effective means for providing backup power to the DRIP **20** in the event the DRIP **20** should lose power from the USB port **18** of the server **14** while an Ethernet session is taking place, such as when the server goes down. This is a significant advantage as it allows a user to still use the DRIP **20** to maintain the user's Ethernet session, and thus to maintain communications with the server **14** remotely via the appliance **10** when the server **14** is re-booting. Of particular importance, this feature allows the user to see the BIOS screen generated by the server **14** as it re-boots. The backup power subsystem **100** is also highly advantageous in that it virtually immediately removes backup power being applied at pins **7** and **8** of the RJ-45 port **12** in the event that a session with the DRIP **20** is lost for any reason (such as if the DRIP **20** is unplugged from the appliance **10**). Still further, the backup power subsystem **100** will not apply any backup power to the pins of the RJ-45 port **12** unless the main processor **32** has verified that it is communicating with the DRIP **20** and an Ethernet session is in progress. These additional safeguards ensure that there is virtually no chance that the backup power supplied by the appliance **10** can be inadvertently applied to some other component besides the DRIP **20**.

The ability to provide backup power to the DRIP **20** also may enhance the ease with which code upgrades may be loaded into the DRIP **20**. For example, it may be possible to program the DRIP **20** such that it is able to be powered up in a limited functionality (i.e., "low power") mode by the appliance **10** when it is just coupled to the appliance **10**. In other words no connection at all would be made between the DRIP **20** and the server; the DRIP **20** would simply be coupled with a Cat5 cable or other cable from an output port of the appliance **10**. Then code could then be loaded into the DRIP **20** from the appliance **10**. It is possible that the DRIP **20** could also be configured to allowing initial flashing of one or more internal programmable memory components through this technique.

It will also be appreciated that if the DRIP **20** is constructed with a feature of reporting back to the appliance **10** the fact that is has begun drawing power from the appliance **10**, then the appliance could readily include a power budgeting feature by which the appliance **10** will only power on up to a predetermined number of DRIPs **20**. This will prevent the possibility of overtaxing the appliance's **10** chassis power supplies if the total of DRIPs **20** that started drawing backup power from the appliance **10** simultaneously added up to more power than the appliance's chassis power supplies could sustain as added load to them (without derating the lifespan of the chassis power supply). This approach ensures there would be no chance that the chassis power supplies of the appliance **10** is inadvertently overloaded. If all of the DRIP **20** devices connected to an appliance **10** draw low enough current to be sustained (all of them at once), then budgeting the maximum number isn't as important. However, if it's desired later to increase the current limit at the shunt regulators **102** and **104** from 100 mA per wire to a greater amount, such as to allow full power mode at the DRIP **20** devices, the entire description of the system in this document can still accommodate that. With a change in the value of the current sense resistor **114**, **136** to allow more current prior to shunt operation, the current per outputs **130** and **142** could be carried up to 200 mA for send current (providing a total of 400 mA received out of two of the Cat5 wires at the DRIP **20**). With that one change, all the logistics of when to turn on or off power that have been described in this document remain the same. But, budgeting how many DRIP **20** devices are on allows for the ability to run several DRIP **20** devices in this new example's full power mode (pulling twice or more the low power mode consumption of 1 W) on multiple ports of the appliance **10**. This ability to budget how many of these DRIP **20** devices there are, and what they should be consuming in power from the main chassis supplies, allows for the appliance **10** to determine how many DRIP **20** devices it can allow to have power prior to overtaxing the chassis power supplies. The allowing or disallowing of full power to the DRIP **20** devices would occur on a port-by-port basis by the appliance **10** turning on or off the backup power subsystem **100** associated with each of those ports (as described previously). And, this was done without adding current draw monitoring devices (on pins **7** and **8** of RJ-45 Port **12**), per each of the Port **12** ports of the system in the appliance (for determining the total system current). This approach allows for significant cost savings in the process of power budgeting the DRIP **20** powering system.

Referring now to FIG. **5**, there is shown an intelligent backup power switching control system **200** in accordance with one embodiment of the present disclosure. For convenience, the intelligent backup power switching control system will be referred to throughout the following description as simply the "control system **200**".

The control system **200** may include a processor **202** and a switching regulator circuit **204** (hereinafter simply the "regulator" **204**) in communication with the processor **202**. In one embodiment the regulator may comprise an ADP 2301 switching regulator available from Analog Devices, Inc., of Norwood, Mass. A USB power input port **206** may receive USB power from the server **14** and apply the power to a first circuit line **208**, a DC power input port **210** may receive a +12V to +6V power supply signal from a conventional, external step down transformer (not shown) and apply it to a second circuit line **212**. An input port **214** may receive backup power from the appliance **10** once the three above discussed conditions are satisfied, and apply the power to a third circuit line **216**. In this example the power control system **200** output may preferably be between about +4.6V to about +3.6V, which is sufficient to power the DRIP **20**.

A circuit detect line **218** provides a "USB Detect" signal to the processor **202** to let the processor know when USB power has been detected. A "DC Input Detect" circuit line **220** provides an input to the processor **202** to let the processor know when a DC input signal from the external transformer has been received. An "Appliance Backup Power Detect" circuit line **222** provides a signal to the processor **202** to let the processor know when the appliance **10** has generated a power signal to the DRIP **20**.

A diode **224** is placed in series in the first circuit line **208**. A second diode **226** is placed in series in the second circuit line **212**, and a third diode **228** is placed in series in the third circuit line **216**. Diodes **226** and **228** have their cathodes tied together at point (i.e., node) **230** and together form a diode-OR arrangement. Diodes **224**, **226** and **228** prevent any leakage of current from an active circuit line (**208**, **212** or **216**) to

an inactive circuit line. An output circuit line **232** is tied to the first circuit line **208** at point (i.e., node) **234** and to an output **236** of the regulator **204**. The diode **224** is further located to be between the input port and the circuit point **234**. Output circuit line **232** receives the output from the regulator **204** which in this example may be about +3.6V.

In operation, when power is available from the USB port **18** of the server **14**, then about +4.6V will be present on first circuit line **208** after the voltage drop by diode **224**. Even if DC power is available at input port **210** from the external transformer, the regulator **204** will remain in an idle state because the voltage on circuit line **208** (+4.6V) will be higher than the +3.6V output of the regulator **204**. Consequently, only power supplied from the USB port **18** of the server **14** will be used to power the DRIP **20**.

The processor **202** monitors the detect lines **218**, **220** and **222**, and as long as it does not detect DC power being present on input port **210** (via a signal from DC detect circuit line **220**), it will communicate with the main processor **32** of the appliance **10** on circuit line **238** to inform the main processor **32** in the appliance **10** that backup power from the appliance **10** may be supplied to the DRIP **20**, provided no power is yet being received from the appliance **10**. As soon as the appliance **10** starts generating backup power to the DRIP **20**, this condition will be detected by the processor **202** via the appliance backup power detect line **222**.

The second circuit line **212** (external DC power) and the third circuit line **216** (appliance backup power) are treated as being mutually exclusive. The availability of power from second circuit line **212** is not under software control. However, the availability of power on third circuit line **216** (appliance backup power) is under software control. By "software control" it is meant that software running in connection with operation of the processor **202** controls when the processor **202** generates a message on circuit line **238** that informs the appliance **10** when power may be applied to input port **214**. It will be appreciated that the input port **214** will be tied to pins **7** and **8** of the RJ-45 port **12** of the appliance **10** via a suitable cable, for example a Cat5 cable. Only when power is not present on input port **210** will the DRIP **20** generate the signal on circuit line **238** to inform the appliance **10** that power may be applied to input port **214**. And as described hereinbefore, the appliance **10** preferably only generates output power on pins **7** and **8** of the RJ-45 port **12** after verifying that it is the DRIP **20** that is the Ethernet device that it is communicating with.

If the processor **202** detects, via DC detect line **220**, that DC power has become available on second circuit line **212**, while power is detected via detect line **222** as being available on the third circuit line **216**, then the software operating with the processor **202** will send a signal via circuit line **238** to the appliance **10**. In this instance the appliance **10** may respond by turning off the power that is being applied to input port **214** of the DRIP **20**. If in some rare instance both input ports **210** and **214** were to receive power simultaneously, this would not cause any problems. Whichever of the circuit lines **212** and **216** has the higher of the two voltages will be the one that will supply power to the regulator **204**. The output of the regulator **204** would still be at its set value of about +3.6V.

In effect, the regulator **204** only provides DC power when power from the USB port **18** of the server **14** is lost, or not present, on input port **206**, and power is present on either input port **210** or input port **214**. But as explained above, power typically will not be present on both of input ports **210** and **214** but rather on one or the other.

In the event power is present on input port **206** and powering the DRIP **20**, and then this power is lost, the voltage at node **234** will begin dropping from +4.6V. It will continue to drop until it reaches the +3.6V level set for the regulator **204**, at which point the regulator **204** will begin operating and generating its +3.6V output. The regulator **204** will maintain the +3.6V output present as long as a DC signal is being received at one or the other of input ports **210** and **214**. If power should again become available from input port **206** (as detect by detect line **218**), the voltage at node **234** (and consequently regulator **204** output **232**) will begin to rise from +3.6V to +4.6V. As the voltage rises above +3.6V the regulator will automatically enter an idle state, and the +4.6V DC signal from the USB port **18** of the server **14** will be used to power the various components of the DRIP **20**.

A particular advantage of the operation of the regulator **204** and the processor **202** is that a change from one power source to a different power source is non-disruptive to system functionality. By non-disruptive, it is meant that the processor **202** does not lose power when a power source transition occurs, and thus never enters a reset state. The power transition from one power source to a different power source appears "seamless" to the operation of the DRIP **20**. Thus, an Ethernet session that the DRIP **20** may have been handling will not be terminated if a power source transition occurs.

An additional feature that may be implemented with the DRIP **20** is a power budgeting feature whereby the processor **202** of the DRIP **20** turns off one or more internal components to effectively place the DRIP **20** in a "low power" mode of operation. This feature could be implemented when the DRIP **20** is being powered by the USB port **18** of the server, and no power is available from input port **210**, and then USB power at input port **206** is lost. In this event the regulator **204** may begin applying its +3.6V output using the power from input port **214** and the processor **202** may simultaneously take additional action to implement one or more of: a reduction in the system clock speed; disable a memory interface; disable USB interfaces; and disable video pipeline. One or more of these actions could insure that potentially multiple DRIPs **20** could remain simultaneously powered to maintain its Ethernet session with its respective server without the DRIPs collectively overtaxing the chassis power supply of the appliance **10**.

Referring briefly to FIG. **6**, a flowchart **300** illustrates one example of a sequence of operations that may be performed by the intelligent power control system **200**. This illustrated exemplary sequence of operations initially assumes that the DRIP **20** is up and running receiving USB power on input port **206**. The processor **202** initially reads the detect lines **218**, **220** and **222**, as indicated at operation **302**. The processor **202** uses the information from detect line **218** to determine if USB power is present, as indicated at operation **304**. In this example since USB power is initially present, this power will continue to be used to power the DRIP **20**, as indicated at operation **306**, and the regulator **204** will remain in its idle mode, as indicated at operation **307**. Operation **307** may also involve authorizing backup power from the appliance **10** if such backup up power is not already detected as being present from the signal on detect line **222**. However, assume that during the next check at operation **304** the processor **202** detects that USB power is no longer present. In this instance the processor **202** will determine if DC power is available from an external transformer at input port **210** by the information previously read at operation **302**, as indicated at operation **308**. If such power is indicated as being present at operation **308**, the processor **202** will allow this power to be used to power the DRIP **20**, as indicated at operation **310**. The processor **202** will then disable backup power from the appli-

ance **10**, if such backup power was detected as being present on input port **214**, as indicated at operation **312**. Operation **302** will then be repeated.

Further to the above, consider now that the check at operation **304** indicates that USB power has been lost, and further that no DC power from the external transformer is available, per the check at operation **308**. The processor **202** will then determine if backup power is present yet from the appliance **10**, as indicated at operation **314**. If it is, then backup power from the appliance **10** will be used as indicated at operation **316**.

The system **200** thus intelligently prioritizes the power available from the various power sources coupled to the DRIP **20** such that power from the server's USB port has the highest priority. Backup power from the appliance **20** is prioritized such that it is only used to power the DRIP **20** when backup power from an external transformer is not available and the power from the USB port of the server **14** is lost. Furthermore, the processor **202** prevents backup power from the appliance **10** from being made available to the DRIP **20** if DC power from the external transformer is available. Moreover, the switching from one power source to a different power source occurs with no interruption to the operation of the DRIP **20**.

It will also be appreciated that while specific voltage levels have been given to help illustrate the various embodiments described above, that these voltage levels could be readily modified to meet the needs of a specific application.

While various embodiments have been described, those skilled in the art will recognize modifications or variations which might be made without departing from the present disclosure. The examples illustrate the various embodiments and are not intended to limit the present disclosure. Therefore, the description and claims should be interpreted liberally with only such limitation as is necessary in view of the pertinent prior art.

What is claimed is:

1. An apparatus for interfacing a communications component to a managed device in communication with the communications component, the apparatus comprising:

a first input for receiving power from the managed device that is used to power the apparatus;

a second input for receiving power from the communications component;

a regulator subsystem responsive to the first and second inputs, and configured to monitor the power provided on the first input; and

the regulator subsystem further being configured to detect when power is unavailable from the first input, and then to automatically use power from the second input to power the apparatus.

2. The apparatus of claim **1**, further comprising a third input for receiving power from an external power source that may be used to power the apparatus.

3. The apparatus of claim **2**, wherein the regulator subsystem is responsive to the third input and allows power provided on the third input to be used to power the apparatus, regardless if power is available on the first input from the managed device.

4. The apparatus of claim **3**, wherein the third input is coupled to a cable in communication with a power transformer, where the power transformer is in communication with an alternating current (AC) power source.

5. The apparatus of claim **1**, wherein the second input is coupled to a port on the communications component via a cable, and receives a direct current (DC) power signal from the communications component.

6. The apparatus of claim **1**, wherein the first input is in communication with a Universal Serial Bus (USB) cable, and the USB cable is connected between a USB port on the managed device and a USB port on the apparatus.

7. The apparatus of claim **1**, further comprising a processor for monitoring the first and second inputs and determining when power being supplied to the first input has been lost or is not present.

8. The apparatus of claim **2**, further comprising a processor for monitoring the first, second and third inputs and determining when power being supplied to the first input has been lost or is not present.

9. The apparatus of claim **8**, wherein the processor is further configured to determine that power has been lost on the first input, or is not available on the first input, and then to make a check to determine if power is available at the third input, and if power is available at the third input the processor is configured to send a signal to the communications component to disable power being supplied on the second input.

10. The apparatus of claim **9**, wherein the processor further is configured to detect if power on the first input is present while power on the third input is not present, and if power is detected to be present on the first input but absent on the third input, then the processor is configured to send a signal to the communications component that power from the communications component may be supplied to the second input of the apparatus.

11. The apparatus of claim **10**, wherein the processor further is configured to detect when power is available on the first input, and that power has become available on the third input, and to communicate to the communications component to disable power being applied to the second input.

12. The apparatus of claim **1**, wherein the regulator subsystem is configured to monitor a voltage present at a node associated with the first input, and when the voltage across the node drops below a predetermined voltage level, to automatically allow power being supplied on the second input to be used to maintain an output of the voltage regulator at the predetermined voltage level, such that the power on the second input is used to power the apparatus.

13. The apparatus of claim **1**, wherein the apparatus comprises a digital rack interface pod, the managed device comprises a server, and the communications component comprises a remote access appliance for enabling a remote user to perform a keyboard, video and mouse (KVM) session over the digital rack interface pod with the server.

14. A digital rack interface pod apparatus for interfacing a remote access appliance to a managed device in communication with the remote access component, the apparatus comprising:

a first input for receiving power from the managed device that is used to power the apparatus;

a second input for receiving power from the remote access appliance;

a third input for receiving power from an external power source, which may be used to power the device;

a regulator subsystem responsive to the first, second and third inputs and for treating a designated one of the inputs as a primary power input that is used to supply power to the apparatus when power is present thereon; and

a processor configured to prioritize an order by which other ones of the inputs besides the designated one of the inputs will be used to draw backup power from in the event that power being supplied to the designated one of the inputs is lost.

15. The apparatus of claim 14, wherein the processor is further configured to:

monitor the first, second and third inputs; and

to communicate with the remote access appliance and to instruct the remote access appliance to interrupt power being provided to the second input if and when power is available on the third input.

16. The apparatus of claim 15, wherein the processor is further configured to communicate with the remote access appliance to inform the remote access appliance to enable power to be supplied to the second input if and when power previously available on the third input is lost on the third input.

17. The apparatus of claim 14, wherein the regulator subsystem is configured to automatically switch from using power from either one of the two said inputs other than the designated one of the inputs, when power that was previously lost on the designated one of the inputs is reestablished on the designated one of the inputs.

18. The apparatus of claim 14, wherein the regulator subsystem comprises a switching voltage regulator configured to:

monitor a voltage across a node associated with the designated one of the inputs; and

while the voltage across the node remains above a predetermined level, indicating that power is being supplied to the designated one of the inputs, the switching voltage regulator will remain in an idle condition in which it does not supply a voltage output.

19. The apparatus of claim 18, wherein the switching voltage regulator is further configured to sense when the voltage across the node drops below the predetermined level and to automatically begin drawing power from one of the other two ones of the inputs besides the designated one of the inputs.

20. The apparatus of claim 19, wherein the switching voltage regulator is further configured to sense, in real time, when the voltage at the node rises above the predetermined level, and to automatically stop drawing power from the other two ones of the inputs, to thus enable power from the designated one of the inputs to again be used to power the apparatus.

21. The apparatus of claim 14, wherein the other ones of the inputs besides the designated one of inputs are tied together at a node such that the regulator subsystem is able to draw power from either of the other ones of the inputs.

22. A method for interfacing a communications component to a managed device in communication with the communications component via an apparatus, the method comprising:

monitoring a first input that receives power from the managed device for powering the apparatus;

using a second input to receive power from the communications component, for powering the apparatus;

using a third input to receive power from an external power source, for powering the apparatus;

treating a designated one of the inputs as a primary power input that is used to supply power to the apparatus when power is present thereon; and

using a processor to prioritize an order by which other ones of the inputs besides the designated one of the inputs will be used to provide power from in the event that power being supplied to the designated one of the inputs is lost.

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